
SCIENCE

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Science Librarianship

Judith Wallen Hunt

Librarian, Bio-Medical Libraries, University of Chicago

AT THE END OF WORLD WAR I there was throughout the Nation a great acceleration of research activities. A similar and even greater expansion of the research programs of industry, the Government, and the universities may be expected within the next decade. Research begins not in the laboratory but in the library, for the literature must be explored to see what has already been accomplished in order to avoid duplication of effort. Because of this focal position, in planning for the future of pure science, industrial research, invention, and engineering development, the library must be given support and attention commensurate with its responsibilities. To meet the needs of a broadly conceived national science program and to meet the demands of an increased clientele, book stocks must be adequate and library staffs skilled in interpreting requests and making resources quickly available.

In the humanities the library does not compete with the laboratory for the attention of the investigator. Because most, if not all, of the research of the humanist is carried out in the library, he has developed greater understanding and proficiency in its use. It is unfortunate that some scientists have little conception of the many facets of library work. Few realize, for example, that the cataloguing department of a university library must be able to handle books written not only in all European languages but also in those of the East, both modern and ancient. Few realize the linguistic abilities, technical knowledge, and subject background necessary to enable the science librarian to interpret the requests made by patrons. A few examples (see Table 1) may create a better understanding.

Many readers find that catalogues of large libraries are difficult to use. They are complex because books are complex. The reader often tells the librarian that more cross-reference cards are necessary. Perhaps this is true, but cross references will never be able to cope with every possible contingency. Rules for transliteration of the Russian alphabet differ, and therefore Russian names and titles of journals will vary, depending on the source of the reference. Some

itinerant scholars change the spelling of their names every time they cross a border. Titles of journals written in the more obscure languages are often translated in literature indexes and abstract journals, and rarely do translators agree. Government documents, national, state, and municipal, are a source of great difficulty. No welter of cross references can take the place of a skilled librarian with imagination, intellectual curiosity, excellent memory, perseverance, and devotion.

Because of early associations with small-town libraries and librarians with limited education and professional training, many readers confuse page boys and desk attendants with professional staff. To them the librarian is a person who hands books over the counter. To stem further confusion, let us analyze the responsibilities of a science librarian of a university library:

Function: Under the general supervision of the director of the university library, to plan, organize, direct, and supervise the activities of the science library and do any other work delegated by the director.

Duties: (1) To make recommendations concerning annual budget revisions for books, services, supplies, and equipment; (2) to formulate departmental acquisition policies and establish criteria of selection; (3) to keep informed of important scientific events, recent advances, and trends in order to make timely materials quickly available; to acquire and maintain an adequate book stock by selecting books and journals, by withdrawing obsolete and inappropriate materials, and by guarding against losses through adequate restrictions and controls; (4) to nominate staff members for appointment by the director and make recommendations concerning promotions, etc.; to employ desk attendants and to devise personnel training programs; (5) to delegate responsibilities and authority to assistants, keep them informed concerning library matters, solicit their advice and suggestions for improving services, and confer with them regarding library problems; (6) to compile and revise instruction manuals describing current circulation practices; (7) to see that catalogues are properly maintained and that other bibliographical tools are up to date; (8) to give instruction in the use of the library and lecture

TABLE 1

AS REQUESTED	AS LOCATED
Acta horti botanici.	Riga. Latvijas universitate. Botaniska darzs. Raksti.
Acta soc. scien. fen.	Finska vetenskaps-societeten, Helsingfors. Acta ...
Arb. a.d. Reichgesundheitsamte.	Germany. Reichgesundheitsamt. Arbeiten.
Arb. neur. Inst. Wien. Univ.	Vienna. Universität. Neurologisches institut. Arbeiten.
Arch. arg. ped.	Archivos argentinos de pediatria.
Battista's work on pathology.	Morgagni, Giovanni Battista. Selections from De sedi-
	bus et causis morborum.
Bechtereff, Vladimir. On nerve function.	Bekhterev, Vladimir. Die functionen der nervencentra.
Bol. inst. clin. quir.	Buenos Aires. Universidad nacional. Instituto de
	clínica quirúrgica. Boletin.
Bul. Commonwealth bur. meteor.	Australia. Bureau of meteorology. Bulletin.
Cajal, S. On degeneration.	Ramón y Cajal, Santiago. Degeneration & regeneration
	of the nervous system.
Jour. cons. perm. int. exp. mer.	International council for the study of the sea. Journal.
Jour. de phys. U.R.S.S.	Fiziologicheskii zhurnal SSSR.
Phys. jour. U.S.S.R.	Fiziologicheskii zhurnal SSSR.
Pubb. del. R. ist. di. studi sup. Firenze.	Florence. Universita. Sezione di science fisiche e
	naturali. Pubblicazioni.
Rep. A.M. Gorky All-Union inst. exp. med.	Moscow. Vsesoiuznyi institut eksperimental'noi med-
	tsiny imeni A.M. Gor'kogo. Otchet.
Rep. pub. health and med. Stat. off.	Great Britain. Ministry of health. Reports.
Russian biochem. jour.	Vseukraïns'ka akademiia nauk, Kiev. Institut biokhemi-
	Biokhemicnyi zhurnal.
Russian jour. biochem.	Biokhimiia.
Russian jour. physiol.	Fiziologicheskii zhurnal SSSR.
Setschenow, J.	Sechenov, Ivan Mikhailovich.
Ver. V int. Kong. Vererbungswiss.	International congress of genetics. 5th, Berlin, 1925.
	Verhandlungen.
Zeit. Phys. Sov. Un.	Fiziologicheskii zhurnal SSSR.

to students and faculty on library resources and bibliography; to give assistance in the use of foreign and complex reference works, in translations and literature searches; (9) to make statistical studies and analyze readers' use of the library to ascertain changes of interest and determine future policies; (10) to contact the library's clientele, give careful consideration to all complaints with a view toward improving services, and handle any difficulties which may arise between the library and its users; (11) to participate in various liaison activities and editorial and committee work, handle correspondence and interviews, represent the library at professional meetings, and keep up with and contribute to the professional literature; and (12) to report annually to the director on the year's progress and shortcomings and make special reports on special problems.

The next question follows inevitably: What are the qualifications necessary to enable a librarian to direct the activities of a science library successfully? As already mentioned, he must have a high degree of intelligence, intellectual curiosity, and an excellent memory. In part, such qualities can be demonstrated by his scholastic record. He must have an advanced degree in either the physical or biological sciences,

with emphasis on those subjects which have major representation in the collection under his supervision. He must have a good knowledge of the history of science and be familiar with the outstanding workers in the fields encompassed by library holdings. He must have a thorough knowledge of cataloguing practices and library administration, with emphasis on university library administration. He must have command of four or more foreign languages and must be able to transliterate Russian. Teaching experience on the college or university level is desirable, since he must be able to lecture to faculty and students on the extensive bibliography of science and be familiar with research procedures. To these qualifications he must add years of varied experience in at least two libraries serving a large research personnel, including work in both the preparations and service departments. Without such experience in a scholarly library, the librarian will be as adequate for his job as a surgeon who has never performed an autopsy or observed and assisted at the operating table.

Only with such qualifications can the science librarian interpret materials for scholarly use. Even librarians of small industrial libraries that serve

research personnel, libraries whose holdings focus on narrow specialties, need similar training to serve their clientele efficiently, for if the library is located in a metropolitan area, the librarian will have frequent recourse to the large libraries within its boundaries. The subject specialist without professional library training is likely to rely too much on memory. Neglect of card catalogues and lack of knowledge of classification schemes, filing systems, and procedures may create in his collection and vertical files an unadulterated mess comparable only to a Chinese puzzle. He will become the so-called indispensable librarian in whose absence no one can find anything.

To locate a librarian with the needed education, professional training, and experience is not easy. The reason is not far to seek. The training grounds are the library schools and the large scholarly libraries of the Nation. As yet, adequate courses have not been offered by library schools, and the linguistic requirements for advanced degrees are insufficient. While a knowledge of German and French may be sufficient for the Bachelor's degree in library science, it seems that the requirements for the Master's degree should be three languages; for the doctorate, four languages. The librarian with a command of four or more foreign languages can do highly effective guessing in many more. Likewise, he must be able to transliterate Russian and, if he can read the handwriting on the wall, he will certainly aim to acquire greater proficiency in this important language.

Recruiting of desirable students is made difficult by the low standards and salaries that prevail in the library profession. To develop librarians who can plan, build, organize, and administer scientific collections that will adequately and efficiently implement the research and instructional activities of the institutions they serve, there is need of a five-point program:

(1) Higher standards for admission to library schools must be introduced. These should be based in part on past scholarship records and on objective data such as I.Q., aptitude, and personality tests.

(2) A clear differentiation must be made between the various types of library work and curricular requirements set up to fit each level of work. Clearly, a student preparing to become librarian of a small-town public library will not need the same training as one preparing for administrative work in a large scholarly library.

(3) Because of the increasing number of science

libraries, new courses should be introduced which take cognizance of this fact, and the title of science librarian conferred only after the proper requirements have been met. Among others, these should include: the M.S. degree, a reading knowledge of four foreign languages, advanced cataloguing, history of science, and bibliography of science. Such a background, when supplemented by two years of internship in both the preparations and service departments of a large science library, will give a good foundation for science librarianship from which, with continued study and broadened experience, to climb to administrative responsibility.

(4) There is need for publicity to familiarize science students with opportunities in the library field. If selection of a profession can be made as early as the junior year, language requirements and courses dealing with the history of science and its specialties can be planned for and in some instances completed before other professional training begins. Commitment at this early date will mean that librarianship is a first choice, whereas postponement may mean that it is a second or third choice made only after frustration in other fields of endeavor. There is likewise need for publicity to familiarize prospective employers with the qualifications necessary for science librarianship. Often personnel officers do not have a clear idea of the training and experience required and so employ librarians not fitted for the work at hand. Such placement is detrimental to both employer and employee.

(5) To attract the highest type of student, financial rewards must compare favorably with other professions. To stimulate his best efforts, a good workman in any field needs to feel respect for his profession, for his position, and for himself. In the case of university librarians, rank, privileges, and benefits commensurate with training, experience, and responsibilities must be accorded (see R. B. Downs. *Coll. Res. Lib.*, 1946, 7, 6-9, 26). Unless science libraries are willing to pay salaries in harmony with educational requirements and unless they are willing to introduce enlightened personnel policies, they will have to content themselves with the failures and refugees from other positions. Men without equipment can improve, devise, build, and secure; equipment without men is worthless. So too, a library without a skilled librarian becomes only a warehouse of books.

Scanning Science—

George Brown Goode died at Washington, D. C., 6 September 1896 at 45 years of age. . . . He not only published in *Science* many articles of great value but also helped continually in its editorial conduct. *Science*, like the Smithsonian Institution, the National Academy of Sciences and other agencies devoted to the advancement and diffusion of science has suffered an irreparable loss.

—18 September 1896

International Cooperation in Scientific Documentation

Atherton Seidell

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DOCUMENTATION MAY BE DEFINED as the activity by which knowledge of the existence of publications and access to them is obtained—that is, as the process of gathering and consulting documents.

Since scientific publication has always been conducted without restraint or organization, there is little possibility that any regulation of its production and distribution can ever be exercised. Attempts in this direction would certainly be futile. Consequently, efforts to promote scientific documentations can be directed only toward perfecting the means by which the numerous scientific publications of the world can be made more widely known to, and more liberally placed at the disposal of, everyone able to use them for the advancement of science. This requires the preparation of lists, inventories, catalogues, or indexes of scientific literature, and the creation of means for the widespread distribution of the original documents or copies of them.

The first of these objectives, the preparation of world lists or catalogues of literature, is a task of such magnitude that it can be accomplished only by the combined efforts of many persons or agencies. In the past, each country in which science has been extensively cultivated has endeavored to produce its own tools of world-wide documentation. This has resulted in considerable duplication of effort and failure anywhere to attain complete coverage of the literature. It is therefore of interest to consider whether it may be possible to organize international cooperation for the production of more accurate and complete literature catalogues than have been made in the past by the independent efforts in various countries.

For such cooperation it would be necessary, first, to choose the number and scope of the subdivisions of science for each of which a separate catalogue of the world literature would be necessary. When this has been done, either the preparation of each catalogue could be apportioned by common consent to one of the cooperating countries, or centers corresponding to language or geographical areas could be set up and charged with collecting the literature originating in these regions and preparing the catalogues of this literature for all of the chosen subdivisions of science. These catalogues could then be reciprocally exchanged and assembled in each of the cooperating countries in accordance with the fields of science covered. They would provide a more complete and accurate coverage of scientific literature than could be made in any one country. They would not supplant the cataloguing, abstracting, or indexing activities at present carried

on in different countries but would provide an extension and perfection of documentary aids to the advancement of science.

Of these two methods of international cooperation the first has the disadvantage that agreements in regard to which country is best fitted to undertake particular assignments would be difficult to obtain, and dissatisfactions would be likely to arise. Furthermore, assembling all that originates in any one country is not an easy task, and collecting the publications of foreign countries is far more difficult. This is due to the impossibility of locating the sources of many of them and the difficulty of establishing connections through which they may be purchased otherwise obtained. The use of several languages and the harmonizing of nomenclature irregularities also create problems.

The plan of having the catalogues made in the countries or groups of countries in which the literature originates would assure greater completeness and accuracy, since they would be prepared by persons having more precise knowledge of the language and the sources and contents of the documents. They would also provide the evidence of the relative scientific production of each country or group of countries. They would be more convenient to use in the countries of their origin and would be no less useful to workers in other countries with different languages than catalogues prepared for them by their own countrymen. The only disadvantage would be the necessity of consulting more than one catalogue in order to find references to work in a given field of science.

The preparation of the catalogues by either of these plans could not be expected to be achieved on a purely voluntary basis, since the incentive to cooperate would not be the same in all countries. There would be need for a central supervising agency, with funds for carrying on the work and competence to advise regarding the forms of presentation and publication. This might well be placed under the auspices of the Science Division of UNESCO.

Since for the preparation of each catalogue the documents would have to be assembled, a microfilm copying service should be provided at each center in order that copies of the less widely disseminated documents could be supplied on demand. This would not deter librarians or individuals from continuing to acquire foreign publications, since they would have just as necessary as ever to permit workers to have immediate access to as large a part of the original literature as possible. It would simply facilitate obtaining copies of the rarer documents, which ordinarily

leave the countries of their origin in very limited numbers.

The literature catalogues, together with microfilm copying, would fulfill in a highly efficient manner the needs of international scientific documentation. They would provide the means by which more complete reviews, digests, and compilations of literature on special subjects could be made and enable everyone engaged in research or in scientific bibliographic work to collect all pertinent publications on a given subject. Finally, they might be expected to reduce the chances that exceptional and important contributions to science might remain hidden and unused for shorter or longer periods of time.

The plans discussed above are based on the principle of cooperatively distributing the work itself among competent persons in the several countries. The possibility of organizing a single scientific documentation center for the entire world may also be considered. It has been suggested that the buildings constructed for the League of Nations in Geneva, Switzerland, would serve admirably for this purpose. These would also furnish the assembly halls and other facilities for holding international scientific meetings. In this case,

the cooperation would be limited to supplying the funds required to pay the staff and provision for the collection of the scientific publications of all countries for transmission to the documentation center.

A single center would, of course, have certain advantages, but the organization of the work on the gigantic scale which would be required would undoubtedly be a very serious problem. Also, questions would be raised as to the prestige and advantages conferred upon the country in which the center is located. Although these imputations would be less in the case of Switzerland than in that of any other country which might be chosen, they would, nevertheless, be made, since scientists are not entirely free of chauvinism even though they recognize the international character of science. The suggestion of a single center of documentation for the world is one deserving of careful consideration in conjunction with the plans involving distribution of the work among the participating nations. Certainly, some kind of international cooperation in scientific documentation is desirable, and its attainment is worthy of the earnest efforts of all who are interested in the advancement of science and human welfare.

Scientific Publication as Affected by War and Politics

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MANY YEARS AGO, THE WRITER BEGAN an analysis of the number of titles published in the different languages each year in the field of psychology. A number of reports have appeared in the *American Journal of Psychology* and in the *Psychological Bulletin*. This work was originally undertaken to impress on graduate students and professional psychologists the necessity of an adequate reading knowledge of English and German, no matter what their native tongue. The first article, published in 1917, indicated certain interesting and important language trends, and hence the writer has made three supplementary reports, each covering an additional 10-year period. By 1938 these trends seemed of such importance that the data from 1894 through 1935 were gathered together in a single article which covered the early development of psychology, World War I, and certain earlier years of the period of economic depression. This latter period covered, as well, certain political changes, especially in Italy and in Germany. Results are now available for the whole midwar years and for World War II.

It must be frankly admitted that the material here presented is limited in scope. Psychology, as a science,

has been extremely fortunate in having a bibliographic service from a relatively early date. From 1894 to 1935 the *Psychological Index* merely listed titles in psychology or in neighboring fields of professional interest to psychologists. Since 1935 the writer has utilized the *Psychological Abstracts*, which supplies abstract service for psychologists.

The materials for the present paper are derived from these two sources. For the present purpose a title is a title, and no attempt has been made to evaluate it, be it a two-volume work or a single page in a journal. Certain sources of error are self-evident. Each title is listed as of the year in which it is mentioned in the *Index* or *Abstracts* rather than as of the actual year of publication. Although there are therefore certain lags, particularly toward the ends of the years, this error is subsequently self-corrective. It is also obvious that such bibliographic services can never be totally complete. Furthermore, the titles listed, particularly in neighboring fields, may vary somewhat from year to year as a result of changes in editorial policy. Finally, the present study deals only with the materials of a single science. However, the writer has been informed by colleagues

in other sciences that the picture presented would probably be true in other and very different fields of scientific endeavor.

Between the years 1894 and 1945, both inclusive, a total of 204,774 titles were listed in these two bibliographic sources, and it is upon this large body of material that the present study is based. The results will be found in Fig. 1. In order to smooth the curves somewhat, the average number of titles for each three-year period is given, except in the cases of the final values for 1945, when the number for the single year is reported. Also, in order to simplify the chart, only three curves are shown—one each for English and German language titles and a third for all of the other languages.

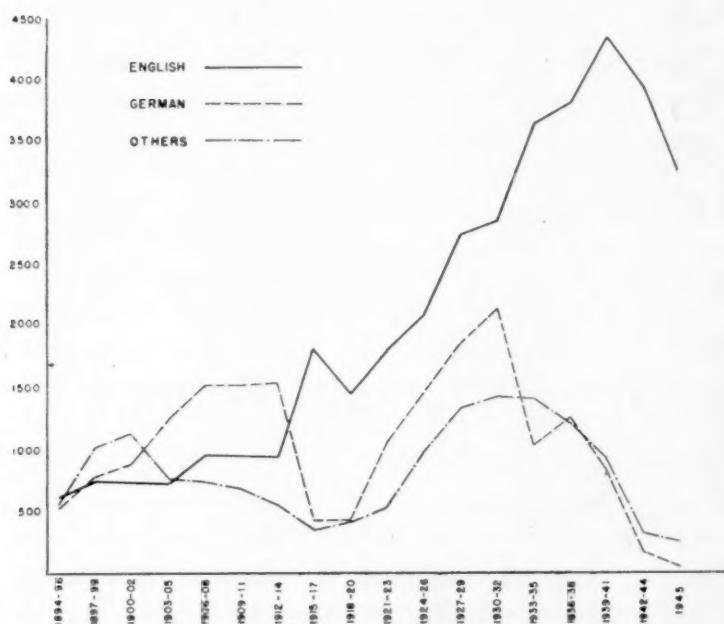


FIG. 1

In the early days of scientific psychology, up to 1905, approximately an equal number of titles was represented in each of the three curves. The "All Others" curve is made up almost entirely of French and Italian titles—a situation which remains true until after 1923. It will be remembered that the turn of the century was the heyday of French abnormal psychology.

The curve for German titles rises steadily through 1908 to a maximum of an average of more than 1,500 titles a year. This level is maintained up to the beginning of World War I. Then, from 1915 through 1920, the curve drops sharply to a minimum of less than one-third of this number. But almost immediately after the war, the curve for German titles rises very sharply to an all-time maximum of over 2,000 titles a year for the period which ends in 1932. This was the year in which Hitler came to power in Germany, and the effect of this political change is immediately obvious with a drop to less than one-half of

the just-previous maximum in the following three years (1933-35). In the next three-year period, ending in 1938, there is evidence of a slight recovery in the German curve, but with the beginning of World War II the German curve drops very rapidly—almost to the point of extinction—with only 187 titles listed in 1945. In Germany the effect of World War II was far more devastating on the volume of psychological publication than was that of World War I. This is particularly true because of the disastrous effects of the previous change of political pattern, which led to the suppression or emigration of so many of the productive scientists in Germany.

The curve of English language titles, most of which are of American origin, has a somewhat different form from the German. Psychology in America developed much more slowly than in Germany. The English curve runs along on more or less of a dead level, of less than an average of 1,000 titles per year until 1914. In the next three-year period (1914-17), there is a sudden and marked increase in English language psychological publication to an average of over 1,600 a year. The American entrance into World War I has the effect of interrupting this increase, a small but definite regression appearing during the three years, 1918-20. The American participation in World War I was of relatively short duration, and hence the effect was not great. From 1920 until 1941, the English language curve rises rapidly and steadily to an all-time maximum average in any language of over 4,300 titles a year. Then came the American entry into World War II, with a decrease in the volume of published productivity, appreciable from 1942 to 1944 and much more marked for the final year of 1945. It is interesting to note that the slopes of the German and English language curves are very similar for the period of World War II.

The curve for all languages, other than English and German, has a form quite different from that of the other two. It rises to an initial maximum of over 1,100 titles during 1900-02. Indeed, for the six-year period, 1897-1902, more titles appeared in French and Italian combined than in either English or German. After 1902, the "All Others" curve, which, as has been indicated, is comprised very largely of French and Italian titles until about 1924, drops steadily to a minimum of 350 titles for the years of the beginning of World War I (1915-17). Curiously, this decline is only slightly hastened by the advent of war—partly because the decline was already so great. During the next six years (1918-23) the curve indicates a slight increase in publication in languages other than German and English.

From 1924 through 1932 there is a steady increase in the number of titles other than English and Ger-

man. This is especially marked during the first six years of this period. The maximum is reached in 1930-32, with over 1,400 such titles. The reasons for this increase are complex. In the beginning it is due to a very marked increase of titles in Russian, but part of this increase, and indeed a considerable part, is due to a rise in national feeling in the smaller countries. Finns felt that they must write in Finnish and Czechoslovakians in Czech. The languages run the gamut from Arabic to Turkish. Before this time, scientists in the smaller countries wrote for the most part in English, German, French, or Italian. These four languages were usually the only ones officially recognized at international scientific congresses. Toward the end of this period an increase in the number of titles in Spanish and Portuguese can be noted, most of which were of South American origin.

The "All Others" curve starts to decline after 1935 and, with the beginning of World War II, declines almost as rapidly as that for German publication, reaching a minimum of slightly over 300 titles in

1945. Of these, nearly one-third are of South American origin.

It would seem that these results have a story to tell. It is true that during the years of the recent war many psychological reports were issued which never reached publication. This is certainly true in the United States, where so much "classified" material was prepared by psychologists within the Services or under contracts with the National Defense Research Committee, the National Research Council, and other agencies. The writer doubts if much of this material will ever be published, partly because of continued classification and partly because the research problems were of a special character which made them useful during the war but frequently of no great scientific or systematic interest after the war is over.

One can only conclude that systematic science cannot flourish during wartime or in a political situation in which the scientists do not have freedom of thought and in which there are continued elements of uncertainty.

A New Classification System for Chemical Compounds¹

D. E. H. Frear, E. J. Seiferle, and H. L. King²

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IN THE COURSE OF SOME RESEARCH INVESTIGATIONS in which the authors have been engaged for the past several years, a simple system for classifying chemical compounds was required. For the purposes of this investigation it was necessary to (a) order the compounds in such a way that an individual compound could be located in a file containing several thousand other compounds with a minimum of effort and possibility for error; (b) arrange the compounds, in so far as possible, so that related compounds would be grouped together in the file; and (c) make possible the collection and statistical study of data on the frequency of occurrence of all chemical groupings appearing in the compounds under study.

After a number of trials with existing classification and indexing systems, including molecular formulas, alphabetical arrangements, and several others, it became apparent that each of these failed, in one way or another, to fulfill the requirements of this investigation. Accordingly, a classification system was devised especially for the work at hand, using an approach which the authors believe to be unique. This

system was first applied in substantially its present form in 1943, and since that time it has been used successfully on approximately 8,000 different chemical compounds. These compounds comprise a group on which insecticidal and fungicidal tests had been recorded and cover a wide range of composition. Both organic and inorganic compounds are included.

Briefly, the present classification is based on "code numbers" assigned to each chemical compound. The code number for a particular compound consists of one or more group numbers, depending upon its type and complexity. These group numbers are assigned by referring to a prearranged list in which constituent chemical groupings (not necessarily functional groups) are given numerical designations. *The groups are listed in decreasing order of complexity.* This is probably the most important feature of the present classification system and, in the opinion of the authors, is the greatest single factor contributing to its workability.

The list of major families is given in Table 1, with one or more examples under each.

Parenthetically it should be noted that the presence of the elements O, N, S, or X (halogen) in the constituent group determines into which family the group falls and is thus the criterion of the complexity of the group. The carbon atom may or may not occur in

¹ Authorized for publication on 22 June 1946 as Paper No. 1334 in the Journal Series of the Pennsylvania Agricultural Experiment Station.

² The second-named author is grateful to the General Aniline and Film Corporation for approving devotion of part of his time to this project.

TABLE 1

FAMILY	EXAMPLE		
I	(CH)ONSX* groups		
	Chlorosulfonamides	-SO ₂ NHCl	3
II	(CH)ONS groups		
	Thiocarbamates	-OC(:S)NH ₂	50
	Sulfonamides	-SO ₂ NH ₂	56
III	(CH)ONX groups		
	Chloroamides	-CONHCl	102
IV	(CH)OSX groups		
	Sulfonyl chlorides	-SO ₂ Cl	151
V	(CH)NSX groups		
VI	(CH)ON groups		
	Amides	-CONH ₂	185
	Nitro compounds	-NO ₂	206
	C ₄ ON ring systems		230
VII	(CH)OS groups		
	Sulfonates	-SO ₃ H	258
VIII	(CH)OX groups		
	Acylbromides	-COBr	330
IX	(CH)NS groups		
	Thiocyanates	-SCN	401
X	(CH)NX groups		
	Chloroamines	-NHCl	477
XI	(CH)SX groups		
	Sulfonyl chlorides	-SCl	521
XII	(CH)O groups		
	Carboxylic acids	-COOH	541
	Hydroxy compounds	-OH	581
	C ₄ O ring systems		625
XIII	(CH)N groups		
	Azo compounds	-N : N-	665
	Amines, primary	-NH ₂	671
	C ₅ N ring systems		730
XIV	(CH)S groups		
	Thiols	-SH	791
	C ₄ S ring systems		825
XV	(CH)X groups		
	Organic chlorides	-Cl	851
XVI	C(H) groups		
	Fused C ₆ -C ₆ ring systems		924
	C ₆ ring systems		951
	Aliphatic C ₁₀ groups		991
	Aliphatic C ₂ groups		1011
XVII	Cationic groups		
	Calcium	Ca	1126
	Potassium	K	1196
	Sodium	Na	1218
XVIII	Anionic groups		
	Bromate	-BrO ₃	1274
	Phosphate, ortho,	≡PO ₄	1356
	Sulfate	=SO ₄	1389

* The symbol X is used in this table to indicate any halogen.

each group and, if present, acts solely as a "nucleus" from which depend the other elements; hydrogen may be present coincidentally to complete the valence requirements of one or more of the elements present.

To determine the code number for a given compound, a very simple procedure is followed. The list of constituent groups is read downward until the most complex group present in the compound is encountered. The corresponding number is noted, the perusal of the list is continued until the second group is encountered, and so on until the entire compound is coded.

A few examples and their code numbers follow:

- (1) 2-Aminoethanol, H₂NCH₂CH₂OH = 581-671-1011
- (2) Metanilic acid, H₂NC₆H₄SO₃H = 258-671-951
- (3) 2-Dodecylpyridine, (C₅H₄N)C₁₀H₂₁ = 730-991
- (4) Acetic acid, sodium salt, CH₃COONa = 541-1011-1218
- (5) *N*-Chloro-*o*-nitrobenzenesulfonamide, O₂NC₆H₄SO₂NHCl = 3-206-951

When compounds are arranged according to the numerical order of their code numbers, a regular and orderly progression is apparent. For example, acetic acid, 541-1011, is followed by calcium acetate, 541-1011-1126, potassium acetate, 541-1011-1176, and sodium acetate, 541-1011-1218. In most cases compounds having similar structures are grouped together when arranged according to this system. All simple phenols and monohydric alcohols, for example, are grouped under 581. To locate a compound in a file arranged according to code numbers, it is a relatively simple matter to work out the code number and determine the proper location in the file within a minute or two.

This system is very well adapted for studies involving the correlation between chemical structure and physical, chemical, biological or other properties. By the use of punch cards listing the constituent groups in each compound under study it is possible to segregate from a collection of compounds all those having, for example, an amino group or any other constituent group whose properties it is desired to investigate.

At the present time the Chemical Codification Subcommittee of the National Research Council Insect Control Committee is revising the system in order better to adapt it to use with machine-sorted punch cards. Full details of the final system will be published as soon as this revision has been completed. In the meantime, comments and suggestions on the coding system and its possible adaptations will be welcomed. Communications may be sent to the authors or to the Chemical Codification Subcommittee, National Research Council, 2101 Constitution Avenue, Washington 25, D. C.

Better Titles, More Effective Publication

O. A. Stevens

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For whose use are titles of articles or books chiefly intended? That titles should be brief and to the point is familiar advice, but I do not recall any discussion which attempts to point out the chief beneficiaries. It seems to be taken for granted that they are the people who may see and perhaps wish to read the articles. Let us examine this more critically.

The average scientific magazine with rather limited field has, perhaps, 1,000 subscribers. Many journals have less; some have more. The number of persons who see the journal is increased, perhaps several times, by library copies. The members of both groups have the journal before them and can examine the article in detail.

The average library has only a small fraction of all journals; the private individual, still less. To meet the needs of persons who do not have access to publications, there are various review, abstract, or index publications. In these, many references appear by title only. Is it not reasonable to conclude that titles are even more important to those who do not have the original article at hand?

If the title is not clear, the abstractor should add at least enough to indicate content. For many articles, title is the chief entry in the abstracting journal. Most journals devoted to original material carry reviews or lists of other articles, and reference to a given book or article often appears in several journals. It must be evident that long titles occupy much space and that both shortening and clarifying titles will help in saving space and making information more readily available. This is particularly important in the case of abstract journals, which have always had a hard time to maintain an existence. Selection of a brief, definitive title is often not easy, but a survey of published articles will show that improvements could be made in a large proportion of cases.

The following remarks concern chiefly ornithology and systematic botany but will, no doubt, apply to other fields. One experiment station publication (*Nebr. exp. Sta. Circ. 69*) was entitled "Leoti for starch." This has brevity at least. It would be intelligible to an agronomist familiar with sorgo strains but to scarcely anyone else. Perusal shows that not mere starch but a special type of starch is concerned. Another title is "Orfed wheat" (*Wash. exp. Sta. Bull. 451*). Presumably this is the name of a variety, but present trends might easily suggest some new method of vitamin enrichment. A recent journal article is entitled "Some evidence in favor of a recent date" (*Lloydia*, Vol. 8, p. 70).

Writers of fiction and other material for popular consumption are prone to conceal the real subject under a title designed to attract attention. *Gone with the wind* is a well-known example. Surely there is little excuse for such in scientific writing, yet it is frequent, espe-

cially in the border line of semipopular material. *My tropical air castle* is familiar to bird students.

Examination of library shelves shows many books which seem incorrectly catalogued. A cataloguer may be misled by an inappropriate title. He cannot be intimately familiar with subject matter in various technical fields and probably is too busy to examine each book critically. Where subject matter is complicated or touches more than one area, classification becomes difficult. If the author would give special care to selection of title and phrase it so that it has an essential word as a lead, the work of the librarian and of all readers would be greatly facilitated. Two entirely similar books are carded in the Library of Congress as follows: Johnson, *Taxonomy of flowering plants*, QK95, and Pool, *Flowers and flowering plants*, SB405. The cataloguer evidently interpreted "flowers" as floriculture.

The writer had occasion to sort some 200 titles in systematic botany. Approximately 20 titles were of the type, "A new *Masdevallia* from Panama," "A new *Mammillaria* species." The name of the species was not given, and often locality was not indicated. These additions might lengthen the title but would make bibliographic references definite. Two revisions of subgenera failed to indicate the name of the genus.

"Studies in the Ericales: a new name in blueberries" is a long title for a brief note and fails to mention the name involved. Several nomenclatural transfers mentioned only one of the names involved and indicated neither conclusions nor content: "*Hugelina* Bentham pre-occupied"; "The status of *Aster longulus* Sheldon"; "*Desmodium glutinosum*." Geographical location is sometimes indefinite, as in "Key to shrubs * * * of Marin County" and "A botanical expedition to Log Spring Ridge." Sometimes not even the name of the plant is shown: "More Berkshire plants"; "Chile tarweed in Quebec"; "Further flowers of the Presidential Range."

A survey of such a group of titles raises the question: What is worth publishing? Another 20 titles include: "*Euphorbia glyptosperma* in Massachusetts"; "*Carex typhina* in Maine"; "*Plantago cordata* in Indiana." New records for North America form a similar group. Little knowledge is conveyed by: "A plant new to the western hemisphere"; "Two plants newly adventive in North America"; "New from Europe." Often the addition of a word or two would complete the title and obviate further comment needed to make the reference intelligible. "*Polygala vulgaris* new to the North American flora" could better be stated, "*Polygala vulgaris* in British Columbia, new to North America."

But why should we need to print a separate item, of perhaps only five lines, requiring a bibliographic entry, for each new species found in a state or in North America? Surely it should be feasible for a journal to devote one page a year, or whatever might be needed, to bring together in one article a series of such records for the continent. State additions every 5 or even 10 years ought to satisfy most purposes.

I was particularly vexed with the entry, "*Astragalus* versus *Oxytropis*," for I had been interested in a plant

described in the former which I had found to belong in the latter. A facetious abstractor had commented: "*Oxytropis* wins with a new combination." On my complaint he graciously inserted the correction, "with a new name." Since I had no access to the original, I still do not know what species was involved.

The preparation of an index containing some 400 titles in ornithology revealed other examples. In the following titles, words which might be deleted are indicated in parentheses: "Reverse migration (of birds) as (a) result of unfavorable weather (in spring)"; "Notes on (the habits and distribution of the) white-tailed eagle in northwestern Iceland"; "Results of catbird banding in (Camden), New Jersey"; "Rhythm in (brooding and feeding) nest routine of (the) black-chinned hummingbird"; "Adaptability of birds to (changed) environments (in early fall)."

This task raised the question: Why do we use 'the,' 'of,' etc. so much? The index was first prepared with abbreviated titles. The matter of quoting literally was brought up, and restudy showed that in many cases this would require only a generous sprinkling of these superfluous words. Of 10 titles in a current journal number, four begin with "a," "an," or "the," and one with "notes on." A recent title, "A systematic study of the main arteries in the region of the heart—Aves VI" (*Auk*, Vol. 62, p. 408), is specific but too long. The running page title, "Study of arteries in the heart," is incorrect and has two superfluous words. A new book of high merit is *The distribution of the birds of California* (*Pac. Coast Avifauna* No. 27). Surely *Distribution of California birds* would serve as well and would reduce the length by 25 per cent.

On the Preparation of Extensive Bibliographies¹

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There are many mechanical methods of procedure in bibliographic work, but we believe that the following steps will approximately represent the average stages of action: (1) location of a publication in an index or elsewhere; (2) exactly and legibly preparing an abstract and copying it on a card; (3) checking copied abstract; (4) numbering, sorting, and indexing; (5) stenciling; (6) checking stencils; and (7) mimeographing and binding.

The last three steps, which can be handled by an office assistant, will not be considered here. The other four processes should be attended to by the researchist himself, and for the third item he can use the aid of an intelligent clerk. Copying abstracts day after day, exactly and legibly, including punctuation and checking the copy, is regarded as routinism by most technically

trained men. It is this part of the work which we think can be largely eliminated.

In a conversation about 25 years ago H. J. Rose (formerly a senior fellow of Mellon Institute and now vice-president, Bituminous Coal Research, Inc., Pittsburgh) mentioned to one of us that, if a piece of sensitized photographic paper is placed face down on a printed page and held in place by a sheet of plate glass, a negative image copy of the printed words or other markings can be developed after exposure to the rays of an electric light. Positive prints can be obtained from the negative by printing in the conventional manner. While this idea is certainly not new at present, it is by no means in general use by scientific workers. Upon extensive inquiry we have found only an occasional individual, not closely identified with photographic work, who is even aware of this bibliographic aid, which we have applied with success and enthusiasm.

At least two brands of photographic paper for this work are on the market. It is a thin stock paper frequently referred to as "Reflex" printing paper and sells for slightly over \$4.00 per 100 sheets (8½ x 11 inches). Items average about 5.5 abstracts to such a page. The paper cost, including the first positive print, is about \$.007 per abstract, and the developing work, which can be turned over to unskilled labor, costs in large batches well under \$.01 per abstract. To this expense is to be added the cost of attaching the untrimmed print to a card for sorting. The total cost should be below \$.02 per abstract. A darkroom is desirable but not essential for this work.

A young scientist receiving \$250.00 per month is paid at a rate of about \$.03 per minute. We find it requires about seven minutes to copy in longhand the average item in a 3,000-item bibliography. It costs nearly as much for two people to check it, and experience shows that usually 2 per cent of the errors will not be caught. The cost for the old procedure would therefore be in excess of \$.40 per abstract placed on a sorting card.

We have found in our suggested procedure that, with an unshaded 150-watt lamp 30 inches above the page, an exposure of 10 seconds is usually satisfactory. Connecting the light and an electric timer in series with a foot switch greatly facilitates this operation. This means that the worker can copy a desired abstract in little more than the time it would take to put the book back on the library shelf. If we accept the foregoing rough approximations, some of which are ultraconservative, we have a total saving of \$350.00 per 1,000 abstracts. In addition, there will be no cross-checking and no transfer errors, most of the drudgery will have been removed, and the work of stenciling will be much facilitated owing to excellent legibility and exact spacing. This inexpensive setup would, of course, also be available for copying letters, graphs, small drawings, or lengthy tables for other purposes.

It is also suggested that work in copying abstracts would be much expedited if the publishers of abstract journals would put at the head of each item the initials of the abstract journal, a serial number, and the number

¹ Contribution from the Multiple Fellowship on Gas Purification sustained by Koppers Company, Inc., Pittsburgh, Pennsylvania.

of the current year or volume—for example, "C.A. 12345-46." *Science Abstracts* and *Biological Abstracts* already employ approximately this system. It makes the abstract journal indexing slightly more definite and in the proposed procedure eliminates labeling of each item.

Punch Cards for Indexing Scientific Data

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Gerald J. Cox

Corn Products Refining Company, Argo, Illinois

Files containing large volumes of scientific data can, and often do, become unwieldy and cumbersome to use. The principal reason is that in the preparation of such files emphasis is usually placed on the manner of putting data into them rather than on ease and facility of getting information out of them. The result is that maximum utility either is not realized or at best is attained at the expense of unnecessarily great time and effort.

In the indexing and analysis of chemical subjects, we have, through the use of punch cards, avoided the difficulties which are inherent in ordinary filing systems, since these cards stress the matter of prime importance—ease and versatility of obtaining any desired information from the file. In most instances only one card is required for each reference, even though it may deal with multiple phases of the subject under consideration. All of those cards pertaining to a specific phase may readily be sorted from the file. The cards need not be filed in any particular order; indeed, there is little loss of efficiency when they are placed at random in the file.

Success with the new system led us to report our experiences in our fields of research (1, 2, 3). The experiences of a few workers in physiology (5), metallurgy (6, 7, 9), and pharmacology (4) are also recorded in the literature, and a spectroscopist has made an oral report (8). In addition, through correspondence and conversation we have learned of a few others who have adapted punch cards to their problems. We feel, however, that this powerful indexing tool has not been publicized as widely as it deserves.

The cards¹ may be obtained in different sizes, although the five- by eight-inch size is probably best suited to most applications. Holes one-eighth inch in diameter are punched one-fourth inch apart along the edges, one-sixteenth inch from the margin. The upper right corners are cut diagonally, so that it can quickly be noted whether all the cards are right side up and facing the same way. Since the holes occupy but a small amount of marginal space, ample room is left for the recording of references, abstracts, experimental data, or other desired information.

A general idea of the purpose of the holes can be conveyed by quoting from one of the above literature cita-

tions (2): "Meanings are assigned to individual holes, and on each reference card at the appropriate holes the portion of the card between hole and margin is clipped open with an adaptation of a ticket punch, changing the hole to a notch. When the sorting needle, resembling a single-tine ice pick, is inserted into a given hole in a group of cards and lifted, the cards, on which that hole has been clipped, drop out and the others stay on the needle."

In this necessarily brief description we make no attempt to give any of the details which should be understood before the punch-card system can be put into operation, since they have been discussed at length in the chemical literature (1, 2). Bulletins published by the card manufacturers are also valuable in furnishing instruction in methods and technique.

Although a number of suggestions could be made to those planning to adopt the indexing system which we have found so satisfactory, we shall confine ourselves to two of fundamental importance. First, the problem at hand must be carefully analyzed, in order to make certain just what kind of information it is desired that the file shall be capable of furnishing. Second, an outline must be prepared to serve as a framework into which all the reference material can be fitted for coding purposes; it is obvious that this step cannot be taken effectively until a considerable familiarity with the field has been acquired. In most cases the outline for a specific investigation can be printed on the card, but for diverse purposes the use of relatively blank cards with separate outlines is advisable.

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A Simple System for Reprint Filing

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The organization of a reprint collection is a problem which must be faced by every serious research worker. Initially there is the accumulation of reprints, but ultimately, if this collection is to retain value, some system must be developed. The desiderata are obvious. The system must be one in which any reprint can be located without waste of time or effort in search. It must be equally possible to return any reprint to its proper place. The system must be capable of continuous extension. The system must be simple and require a minimum of effort to develop and keep in order. Less obvious,

¹The cards and necessary inexpensive accessory equipment are manufactured by the McBee Company ("Keysort"), Athens, Ohio, and the Charles R. Hadley Company ("Rocket"), Los Angeles, California.

but equally important in the long run, the system must not be wasteful of space or expensive to maintain.

Roger Smith, in his excellent *Guide to the literature of the zoological sciences* (Burgess Publishing Co., 1943), gives an account of methods which are in common use. He points out the objection to filing in boxes or folders arranged by author or subject, namely, the great opportunity for waste of space. In particular he disapproves of filing by author as having the additional disadvantage that the name of the author must be the key to locating any one separate. He advocates the filing of reprints numerically in order of receipt and without regard to author or subject. In this method, a card index must be maintained for the location of any reprint by author or by subject. This system is unnatural. An additional and unnecessary complication is achieved by the introduction of filing under an artificial set of numbers which are completely unrelated to the matter in the system. A reprint is as frequently sought by author as by title, and neither of these directions can be followed in this method without reference to a card index. In fact, to make the system work adequately, it is found in general practice that card indexes must be maintained for both authors and titles.

It is obvious that a collection of reprints will rapidly outgrow any single-entry system such as filing solely by author or solely by subject, and the minimum satisfactory system is one containing a cross index. Accordingly, two files must be set up. Obviously, there is no limit to a subject group. A file under entomology could grow to astronomical proportions. On the other hand, the work of an author is definitely limited, although a Cope or a Sars would tax any system. In setting up a cross index it is logical that we should file the smaller items in the subject group and the larger in the author group. A cross index for reprints must mean an index of cards on the one hand and an index of reprints on the other. By indexing the cards by subject, large groups can be

handled in a minimum of space, and in actual practice such groups can be submitted to any desired degree of breakdown. Reprints, the larger objects, should be filed in the naturally limited author groups.

The writer has employed such a system for nearly 15 years without breakdown in any part of the system or the development of cumbersome groups requiring extended search. All reprints are filed by author. The work of each author is held in an open-ended heavy manila envelope, 10 inches wide by 13 inches long. The author's name is printed by hand boldly across the end of the envelope close to the margin. The envelopes are filed alphabetically on edge on an ordinary shelf with the closed end and author's name outwards. The mouths of the envelopes are to the back of the shelf, and in this way the reprints are kept clean and away from light. Any reprint can be located directly by author and as readily returned to its proper position.

One card is prepared for each reprint. The card carries the ordinary reference data and is filed by subject groups along with all other references to literature. I have found it valuable to employ code signs in the upper right-hand corner of each card, indicating whether the reference is to a work included in the reprint collection, to a paper in a journal in my possession, or to a work not in my possession.

The system is capable of infinite expansion on either side. It works equally well with a small or large collection of reprints. It can be readily organized and is inexpensive. The cost of heavy manila envelopes is far less than for boxes or folders and a cabinet file. The system is not wasteful of space, little more space being occupied than for the reprints themselves, and reprints of all ordinary sizes can be conveniently held in the system. Reprints can be located readily by subject, the aggregation of cards in subject groups enabling this to be done without search.

Obituary

Louis A. Slotin 1912-1946

All who watch for cyclotron beam current, all who count tracer activity, mourn the loss of Louis A. Slotin, who died on 30 May 1946 from the effects of radiation from an accidental chain reaction of plutonium. He was, in a way, the chief atomic armorer of the United States, but he had been eager to return to peacetime work. The possession of unique skills obligated him to continue work at Los Alamos and at Bikini until the Navy tests were completed. He had planned to accept an assistant professorship at the

Institute of Biophysics and Radiobiology at the University of Chicago in the fall.

Though quiet and unassuming, Slotin had led an unusual life. He received a B.Sc. degree in geology from the University of Manitoba in 1932, a M.Sc. degree in 1933, and a Ph.D. degree in physical chemistry from the University of London in 1936. Slotin was a modern adventurer and was drawn to every center of activity where there was promise of excitement. At one time he trained to fly a fighter plane with the RAF, until the discovery was made that he wore glasses. Earlier, he was visiting a friend in Barcelona when the Spanish civil war began; he

joined the Loyalists, for whom he operated an anti-aircraft gun.

While passing through Chicago on his way back to his home at Winnipeg in 1937, a chance conversation led Slotin to accept a job to help construct the new cyclotron at the University of Chicago. This served as his introduction to nuclear physics. He contributed to a number of papers in radiobiology before beginning to work in the Metallurgical Laboratory of the Manhattan District Project when it was centralized in Chicago in 1942. Always following the center of activity, Slotin went to Oak Ridge to help with the Clinton pile development there. There he worked to start the first power-producing pile. When the problems of plutonium production were solved, Slotin moved to Los Alamos to assist in the critical problem of fabricating a bomb.

It was Slotin who was responsible for assembly and delivery of the first atomic bomb to the Army for the "Trinity" test in the desert. The receipt which he received when he turned this, the first atomic bomb, over to the Army was one of his most prized possessions, since it represented the culmination of the whole \$2,000,000,000 effort of the Manhattan District. Slotin had wanted very much to go to Tinian, the launching point of the Hiroshima and the Nagasaki bombs, in the summer of 1945. He was still a Canadian citizen, several weeks short of his final American papers, and the legal delay which resulted kept him at Los Alamos until the end of the war.

He had been scheduled to go to Tinian for the third bomb.

Slotin was well aware of the danger of his work at Los Alamos. One of his co-workers, Harry Daghlialian, died last September from exposure in a similar accident, and Slotin had stayed at his side during the weeks until Daghlialian's death. He felt obliged, however, to continue the work until another physicist could be trained to take the responsibility. The accident of 21 May occurred while he was instructing his replacement in the touchy techniques of critical assembly, no less needed in peace than in war.

Physics, and especially the difficult and specialized field of nuclear physics in its application to biology, will suffer from Slotin's loss. He had an intimate and a rich experience with the techniques of both chemistry and nuclear physics few others enjoyed and preferred often to help others rather than to work on his own ideas. He was undeterred by big undertakings and great responsibility. He was the man in the laboratory who was always willing to take the time and lend his skill to make real any promising idea that came up. Those of us who worked with Slotin loved him for his selflessness, his modesty, and his sure and quiet competence.

Nine days after the exposure Slotin died. His death, like his life, was quiet, brave, and clear.

H. L. ANDERSON and A. NOVICK

University of Chicago

P. MORRISON

Los Alamos Laboratory

News and Notes

About People

Alexander Craig Aitken, a native of Dunedin, New Zealand, has been appointed to the chair of mathematics, University of Edinburgh.

Anton J. Carlson was nominated at the San Francisco session of the American Medical Association to receive the citation and Distinguished Service Medal of the Association. Dr. Carlson received the B.S. and A.M. degrees from Augustana College and the Ph.D. from Stanford University. After serving as research assistant in physiology at Stanford, he became associated with the Carnegie Institution and from 1905 to 1907 worked as an instructor in the Woods Hole laboratories. He was appointed assistant professor

and then professor of physiology at the University of Chicago, and in 1929 became Frank P. Hixon distinguished service professor. He retired in 1940 with the title emeritus.

William H. Feldman, the Mayo Foundation for Medical Education and Research, was awarded the Alvarenga Prize for this year on 14 July by the College of Physicians (Philadelphia), in recognition of his studies upon chemotherapy in tuberculosis. The prize was established by the will of Pedro Francisco daCosta Alvarenga, of Lisbon, Portugal, an associate fellow of the College, to be awarded annually on the anniversary of his death, 14 July 1883. The recipient is invited to deliver an Alvarenga Lecture before the College.

Clifford Frondel has been appointed associate professor of mineralogy and curator of the Mineralogical Museum, Harvard University, succeeding the late Harry Berman.

Eugene C. Crittenden received the Doctor of Science degree on 16 June from the Case School of Applied Science. Dr. Crittenden is an associate director of the National Bureau of Standards and for 25 years was the chief of the electrical division of the Bureau. He has served as president of the Illuminating Engineering Society, of the Optical Society of America, and of the Washington Academy of Sciences. He is president of the U. S. National Committee of the International Electrotechnical Commission, and served in a similar post for the International Commission on Illumination.

John F. Suttle and *Warren S. MacGregor* will join the staff of the Department of Chemistry, University of Portland, on 1 September. Dr. Suttle was formerly of Indiana University, and Dr. MacGregor, with the Atlas Powder Company.

Willis T. Tressler has resigned from the Department of Zoology, University of Maryland, to accept a position with the War Department as of 1 September.

Bruno Jirgensons, chemist and until 1944 at the Latvian University in Riga, was evacuated to Germany by the German military forces, according to word recently received. He is at present in the Latvian Displaced Persons Camp at Lauingen, Bavaria, Germany, U. S. Zone, where he is working on *Lehrbuch der Kolloidchemie* under the general editorship of J. Springer, of Berlin. Both Bruno Jirgensons and his brother, A. Jirgensons, an engineer specializing in lanital, galalith, and nylon, are anxious to come to the United States.

Charles E. Olmsted, University of Chicago, has been appointed editor of *The Botanical Gazette* to succeed E. J. Kraus, effective with the September issue. At that time the journal, published quarterly by the University of Chicago Press, begins its 108th volume.

P. Swings has declined an appointment as professor of astronomy at the Berkeley Astronomical Department, University of California, and plans to return to his native Belgium.

R. I. Throckmorton, for 21 years head of the Department of Agronomy, was appointed dean of the School of Agriculture and director of the Agricultural Experiment Station, Kansas State College, effective 1

July. He succeeded L. E. Call, who has become dean and director emeritus. H. E. Myers has been appointed head of the Department of Agronomy.

George D. Louderback and *Wendell M. Stanley* received the degree of Doctor of Laws at the University of California's 83rd commencement exercises, held on 22 June at Berkeley. Dr. Louderback is professor emeritus of geology, University of California, and Dr. Stanley, a member of the Rockefeller Institute for Medical Research, Princeton, New Jersey.

Richard M. Foose, senior geologist of the Pennsylvania Geological Survey, Harrisburg, will resign from his position on 1 September to become professor of geology and head of the Department of Geology, Franklin and Marshall College, Lancaster, Pennsylvania. He will continue to serve as a consulting geologist.

A. C. Ivy, Nathan Smith Davis professor of physiology, Northwestern University Medical School, has been appointed distinguished professor of physiology in the Graduate School and vice-president, University of Illinois, in charge of the Chicago Professional Colleges, effective 1 September. Dr. Ivy will teach "Interpretation of Symptoms" in the senior year of the Medical College and continue physiological and clinical investigation, for which facilities have been provided.

Alice M. Boring, who has been a visiting professor of zoology at Mount Holyoke College for the past academic year, sailed from Galveston, Texas, on 12 July to return to Yenching University, China, where she was professor of biology from 1923 until the University was closed by the Japanese on 8 December 1941. Yenching opened freshman classes on 10 October 1945 (Chinese Independence Day), and hopes to carry on a full schedule of normal work this coming fall for the academic year of 1946-47.

Ralph Alanson Sawyer, technical director of the atom bomb tests at Bikini Atoll, has been appointed dean of the Horace H. Rackham School of Graduate Studies, University of Michigan, effective in September, to succeed the late Clarence S. Yoakum.

Announcements

A report of the Action Committee on Surplus Property was made during July to 21 national educational organizations. The report pointed out that almost two years had elapsed since Congress passed the Surplus Property Act of 1944, providing benefi-

to education in the disposal of surplus government property. During this time various regulations issued by the War Assets Administration under the authority of this act have failed to carry out its intent, so that today the "problem of issuing educational institutions fair and equitable access to surplus property remains unsolved." According to the report, every effort of the Committee to secure fair and reasonable interpretations of the regulations has met with delay and frustration. Efforts of the Committee to deal directly with the War Assets Administration "while met courteously have not been productive of any results whatsoever." On 2 July representatives of the Office of Scientific Personnel, Association of American Colleges, National Educational Association, Association of School Business Officials, American Vocational Association, American Council on Education, and others met with President Truman to discuss the problem. The President indicated that he would instruct the appropriate government officers to do whatever they could to expedite the distribution of surplus property to colleges. In his report for the month of June, M. H. Trytten, director of the Office of Scientific Personnel, says: "There is better reason to hope for a changed Administration attitude in this matter than at any time in the past."

Some 140 delegates from various academies of science met in Burlington House, 15 July, for the Royal Society's Newton tercentenary celebration, which should have taken place in 1942 but was postponed to this time. *Nature* of 19 December 1942, however, contained articles by Prof. E. N. da C. Andrade, Lord Rayleigh, and Sir James Jeans in celebration of Newton's birth, which occurred 24 December 1642. The U. S. delegation was composed of: Walter Adams, Marston Bogert, Frederick E. Brasch, Leonard Carmichael, Leslie Dunn, Jerome Hunsaker, Herbert Ives, Walter R. Miles, Peyton Rous, and Theodor von Kármán.

Sir Robert Robinson announced that it was proposed to establish an Isaac Newton Observatory in England and that the Chancellor of the Exchequer had agreed to ask Parliament for a sum of money for the project. The details are not yet settled, but the proposal involves the construction of a 100-inch reflector and accessories, which should be the property of the government.

Prof. Max Planck was present in spite of his 88 years.

In the afternoon E. N. da C. Andrade lectured on the life of Newton, who took an active part in parliamentary affairs. In addition to his active scientific life, he was member of Parliament for Cam-

bridge in 1688 and was appointed Master of the Mint in 1699. In 1703 he was made president of the Royal Society, which office he held until his death in 1727. He was knighted in 1705, an honor which, according to Prof. Andrade, was "never before conferred for services to science."

Other items on the program for the remainder of the week were lectures by the late Lord Keynes (read by Mr. Geoffrey Keynes) on "Newton, the Man"; by Prof. J. Hadamard on "Newton and the Infinitesimal Calculus"; by Academician S. Vavilov (read on his behalf) on "Newton's Atomism"; by Prof. Niels Bohr on "Newton's Principles and Modern Atomic Mechanics"; by Prof. H. W. Turnbull on "Newton: The Algebraist and Geometer"; by Dr. Walter Adams on "Newton's Contributions to Observational Astronomy"; and by Dr. Jerome C. Hunsaker on "Newton and Fluid Mechanics."

The Mount Desert Island Biological Laboratory, Salsbury Cove, Maine, is in operation again after being closed during the war. Twenty-two biologists are in the colony, representing 12 institutions.

The Naturalists' Directory, containing names, addresses, and special subjects of study of professional and amateur naturalists throughout the world, will again be issued in September. Naturalists may send information about themselves to be inserted in the new Directory without charge. Directories may be obtained by sending \$3.00 to: The Naturalists' Directory, Salem, Massachusetts.

The McLennan Laboratory, Department of Physics, University of Toronto, through its director, E. F. Burton, announces that a graduate course will be given next year for the purpose of training graduate students in all phases of electron microscopy theory and practice. The course, which will be limited to six students with advanced training in mathematics and physics, will be accepted as work toward the M.A. degree. Candidates must be acceptable to the School of Graduate Studies, University of Toronto.

The Brooklyn Botanic Garden announces a fellowship, available immediately, for research on plant growth. The stipend depends somewhat upon the qualifications of the candidate but is limited to not more than \$3,000 per annum. Applicants need not possess a Ph.D. degree but should have training and/or experience which will qualify them for either independent or cooperative work. Letters of application should state age, training, and experience and be addressed to George S. Avery, Jr., Director, Brooklyn Botanic Garden, 1000 Washington Avenue, Brooklyn 25, New York.

An inorganic solids research project has been established at Northwestern University, according to Robert K. Summerbell, chairman of the Department of Chemistry. The work, which will be directed by P. W. Selwood, will be a fundamental study of inorganic solids such as manganese dioxide and related compounds. Particular attention will be paid to oxides of the transition group elements. The project will concern itself with the preparation of pure inorganic solids, the accurate characterization of these substances as to physical and chemical properties, and the behavior of such substances in catalytic and electrochemical changes. It is anticipated that substantial additions will be made to the already well-equipped X-ray and magnetochemical divisions of Northwestern University. Heavy reliance is expected to be placed on the method of susceptibility isotherms recently discovered by Dr. Selwood as one of the most powerful tools at the disposal of the chemist interested in the structure of catalytically active solids.

This project, which is made possible by an agreement with the Squier Signal Laboratory, Army Service Forces, will be of interest to the Signal Corps Engineering Laboratory in connection with the manufacture and properties of dry cells and other types of batteries. The contract is for a two-year period and will involve the sum of \$36,200 for personnel, equipment, and supplies.

The *Annales d'Astrophysique* is being reorganized as an international medium for the publication of articles on astrophysics, according to an announcement by the French National Center of Scientific Research (CNRS).

F. Joliot-Curie, director of the CNRS, has nominated the following committee to organize the French Service d'Astrophysique: Mr. Danjon, Paris Observatory, chairman; Mr. Chalonge, Paris Observatory and Institute of Astrophysics, vice-chairman; Mr. Mineur, Paris Observatory and Institute of Astrophysics, secretary; and Messrs. Coulomb, Dufay, Fehrenbach, Lyot, Couder, Lallemand, and Barbier, members.

An international board of foreign correspondents has also been formed, including Messrs. Abetti, Beals, Gaviola, Lindblad, Mayall, Menzel, Merrill, Oort, Plaskett, Redman, Russell, B. Strömgren, Struve, and Swings. Under the new plan the *Annales* will accept articles from all countries and will be prepared to print them in one of three languages: French, English, or German.

During the war the *Annales* published two issues per year. Those for 1945 were expected to appear in the early part of 1946. The first issue of 1946, which started the international series, was expected to appear in the middle of the year. The editor-in-chief, Dr.

Barbier, hopes to increase the number of issues to three per year, and if circumstances should warrant there may be as many as six or eight issues per year. The address of the editor is: Institut d'Astrophysique, 98 bis, Boul. Arago, Paris (14ème), France.

The National Registry of Rare Chemicals, Armour Research Foundation, 35 West 33rd Street, Chicago 16, Illinois, has submitted their new needs in the following list of chemicals: cholesteryl oleate; tetrahydro- β -naphthol (ac); 2-phenyl cyclohexanol; 1,d,- or dl-pseudoephedrine or salts; 1,d,- or dl-norephedrine or salts; stachyose; lactosine; silicon trichloride; methyl nitrate; propyl nitrate; propyl nitrite; saccharic acid; carnaubyl alcohol; ceryl alcohol; myricyl alcohol; 2,4-dichlorobenzoyl K acid; phenoxazine; isodigitoxigenin; scillaren A; uzarin; iron pheophytin; and rosamine. Please communicate regarding these directly with the Registry at the address given above.

An Antibiotic Study Section has been formed under the direction of the National Institute of Health, U. S. Public Health Service, according to R. E. Dyer, director of the Institute. The chairman of the new Section is Hans T. Clarke, College of Physicians and Surgeons, New York, and the secretary, C. J. Van Slyke, National Institute of Health. The other members of the Section are: David P. Barr and Vincent du Vigneaud, Cornell University; R. D. Coghill, Abbott Laboratories; Harry Eagle, E. K. Marshall, Jr., and J. E. Moore, The Johns Hopkins University; R. P. Herwick and Henry Welch, Food and Drug Administration; Colin MacLeod, New York University; Oskar Wintersteiner, E. R. Squibb and Sons; W. Barry Wood, Jr., Washington University; Milton V. Velde, National Institute of Health; Arthur M. Walker, Veterans Administration; Capt. George B. Dowling, U. S. Navy; and William Leifer, U. S. Army.

The primary interest of this Section at the moment is in fostering fundamental chemical and biological studies of antibiotics with particular immediate reference to commercial penicillin; its known species, G, X, F, and K; new and modified penicillins; and impurities contained in penicillin.

The National Institute of Health is prepared to consider applications for grants-in-aid from investigators interested in these fields. Applications should be made to Dr. Van Slyke, Secretary, Antibiotics Study Section, Research Grants Office, National Institute of Health.

The All-Union Committee on Standards of the USSR has applied for membership in the United Nations Standards Coordinating Committee and has been welcomed by Executive Committee Chairman James G. Morrow, of Canada, according to an announcement made recently by H. J. Woilner, secre-

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Secretary-in-charge of the New York office of UNSCC. With the inclusion of the Soviet national standards body, the membership of the UNSCC now includes 18 countries. The Committee, which grew out of conferences held between the national standards bodies of Canada, the United States, and Great Britain in the later stages of World War II and which has expanded to include the national standards bodies of the other United Nations as they applied for membership, is active in coordinating national industrial standards and in planning a broad permanent peace-time program of collaboration between nations.

The UNSCC held a conference in New York last October at which discussion was largely devoted to the drafting of a constitution for a new permanent international standards organization. The draft constitution is now being examined by the national member bodies who will discuss it further at a conference to be held in London this October.

The American representative on the UNSCC is the American Standards Association, of which Henry B. Ryans, of the Philadelphia Electric Company, is president. Howard Coonley, formerly chairman of the Board of the Walworth Company, is chairman of the ASA Executive Committee, and P. G. Agnew is vice-president and secretary.

Outstanding aspects of European developments in artificial limbs and surgical techniques for amputation cases have been reported in person to Secretary of War Robert P. Patterson and Maj. Gen. Norman T. Kirk, Surgeon General of the Army, by the group of scientists recently sent to England, France, and Germany for this purpose.

This mission was headed by Paul E. Klopsteg, chairman of a committee appointed by the National Research Council last year to engage in a broad program of research in this field. This research was started at the Surgeon General's request and is now under the joint sponsorship of the Army and the Veterans Administration. The group making the European study was made up jointly of members of the Committee and of the Surgeon General's staff, and included surgeons specializing in amputation cases and research engineers.

Dr. Klopsteg said that no other country is conducting a program of research in this field in any way comparable to the great effort here, for which the Army has already provided \$1,000,000. While it was found that the work in this country on most aspects of the problem is far advanced when compared with that in Europe and that the materials for and construction of artificial limbs are superior here, information of significant value was obtained from the European studies.

Dr. Klopsteg reported to the Secretary and to the Surgeon General that he was confident that artificial legs incorporating the European improvements could successfully be developed by American scientists and qualified contractors. He also expressed confidence that the new development in cineplastic surgery, when used in conjunction with improved types of artificial arms, now in process of development or which can be evolved from the present research program, would enhance the prospect for many arm amputees.

Secretary Patterson directed that the War Department continue to give every possible support, financial and otherwise, to the Committee's research program, and stated that he proposed to ask the direct aid of certain other large corporations with great research divisions to speed up the work still further. Several companies are already so engaged under contracts with the Committee.

The Instituto de Estudos Brasileiros has suspended its meetings and the publication of its journal, *Estudos Brasileiros*, by a decision of its governing board, according to a recent announcement.

The Summit Corporation, Scranton, Pennsylvania, was recently organized to carry on fundamental research in the fields of electronic physics, and electrical, mechanical, and chemical engineering. Otto J. M. Smith is the chief electrical engineer of the new Corporation. Dr. Smith has been an instructor at Tufts College, assistant professor at Denver University, research engineer at the Westinghouse Electric Corporation, and chief electrical engineer at the Scranton Record Company.

A growing trend on the part of academic and industrial scientists to work together more closely in the furtherance of research was underscored in a ceremony at Corning, New York, in May, when the Research Club of Corning Glass Works was installed as a member club of the Society of the Sigma Xi, national scientific honor society. This marked the fourth time that an industrial science group has been admitted to membership in Sigma Xi.

In the absence of Harlow Shapley, Harvard University, president of the Society, J. G. Baker, of the Harvard Observatory, delivered the charge to the new affiliates. Carleton C. Murdock, representing the Executive Committee of Sigma Xi, presented the charter of membership to Gail Smith, Research Club president. Principal speaker of the evening was E. C. Pollard, physicist, Yale University, whose subject dealt with "The Elementary Particles of Nature."

Ernst Gäumann, mycologist, Eidg. Technische Hochschule, Institute für Spezielle Botanik, Zurich, Switzerland, has written that Dr. Petrak is alive in Vienna

and working at the Natural History Museum. Dr. Gäumann also writes that letters can be sent to Germany only by giving them to American or English soldiers who spend their holidays in Switzerland.—*B. B. Mundkur* (Imperial Agricultural Research Institute, New Delhi).

The Physics Department at the University of Southern California has added the following men to its staff during the past year: C. M. Van Atta, professor; John Backus, associate professor; Edward Gerjuoy, Willard Geer, John R. Holmes, William Parkins, and G. L. Weissler, assistant professors. Profs. Backus, Holmes, Parkins, and Van Atta were formerly connected with the Manhattan Project at Berkeley, California; Prof. Gerjuoy was the assistant director of the Sonar Analysis Group at Washington, D. C.; and Prof. Weissler was on the faculty of the University of California Medical School.

The Lamme medal for engineering achievement from Ohio State University was awarded to Rear Adm. Charles A. Park at the University's commencement exercises on 7 June. The medal, which is a gift of the late Benjamin G. Lamme, long-time chief engineer of the Westinghouse Electric and Manufacturing Company, goes each year to an Ohio State alumnus who has won distinction in engineering.

The Biological Abstracts Report for 1945 summarizes the 20-year history of the publication. Nineteen volumes have appeared covering 425,000 research papers. The last volume alone contained 23,446. The editor-in-chief, John E. Flynn, pays tribute to the "generous and unselfish cooperation of 3,000 abstracters and 157 section editors whose work is done without financial reward." After a period of some uncertainty following the loss of a subvention in 1935, the publication appears to be in a strong financial position.

Upon recommendation of the Library of Congress, the NDRC Office of Scientific Research and Development has selected some 20 public and university libraries throughout the country to be repositories for technical reports issued by the Radiation Laboratory. The reports cover all phases of microwave radar developments, fundamental research in electronics, development, design, and engineering of circuit elements, components, systems, and auxiliary equipment. Only a limited number of these technical reports are available.

The Farlow Herbarium of Harvard University has received word that a valuable collection of over 3,000 specimens of Malaysian Hepaticae, chiefly epiphytic Lejeuneaceae gathered by Frans Verdoorn, as well as

some other collections assembled by him between 1925 and 1926 which were on loan at the outbreak of the war to the Botanical Institute of the University of Jena, is safe. Th. Herzog, one of those working on this collection, placed most of it during the early war years in a country home near Jena. Although this house was almost entirely destroyed by a bomb, the specimens were found in undamaged condition in the wreckage of the basement and were removed subsequently to a part of the basement at the Botanical Institute. At a later date this building was also destroyed, nine students being killed and the director Prof. Renner, seriously wounded. The bryological collections were fortunately in a wing where the basement withstood the bombing. Work on them is now being continued by Prof. Herzog and his assistants, Drs. Benedict and Schuchardt.

Wesleyan University announces the retention of R. G. Clarke as director, W. C. Nelson as assistant director; C. B. Ford and W. P. Senett as group leaders, and R. W. Fabian as chemist of the ORDWES project located on its campus. G. Albert Hill is serving as chairman of the ORDWES Consultative Board and W. G. Cady and B. H. Camp, as members of the Board.

The Program and Research Laboratories of the Illinois State Geological Survey

The Illinois State Geological Survey, located at Urbana-Champaign, on the campus of the University of Illinois, has for many years been engaged in a program of fundamental and applied research on the geology and mineral resources of Illinois.

The scope of the Survey's program begins with basic research in stratigraphy and structure of the rock formations and extends through studies of the natural occurrence and composition of mineral deposits, their physical and chemical properties, and possibilities of improved and new utilization, to an analysis of the mineral economics of the natural market area. Attention is also given to educational extension among high schools, technical societies, and the body politic. Over a period of 14 years this sort of broad program has been carried out and its value fully demonstrated in the case of a state of large population, extensive natural resources, and high industrialization.

For the current year the specific program may be briefed as follows:

Stratigraphy and paleontology: Ordovician, Silurian, Mississippian, Pennsylvanian, and Pleistocene stratigraphic and structural studies; conodonts of the black shales of Devonian-Mississippian age involving a consideration of the intersystem boundary; and spores of the coal beds of the Pennsylvanian.

Areal geology: completion of reports on the geology and mineral resources of several quadrangles; engraving and publication of a revised geologic map of the state.

Paleophysiography: studies of buried valley systems beneath the Pleistocene deposits.

Coal studies: detailed mapping and study of important coal beds to provide essential information for further exploration for coal and to aid in the study of oil and gas structures; petrographic analysis of the banded ingredients of coal to assist in a better understanding of its properties; proximate and ultimate analyses and determination of heat values; preparation and combustion studies designed to improve coal preparation for better stoker coals; pilot-plant coking tests of coals for metallurgical coke in cooperation with the steel industry; briquetting of coal fines (waste) without binder to produce "smokeless" briquettes; and beneficiation of coal sludge by oil flotation.

Oil and gas studies: geology and oil possibilities along the eastern rim of the deeper part of the Illinois basin; subsurface structure map of the base of the "Barrow limestone" in the Goleconda formation of central and southern Illinois; geological and engineering studies to appraise the application of secondary recovery methods in certain areas; reservoir conditions of certain pools; publication of revised Oil and Gas Map showing pools and pipe lines.

Zinc and lead resource studies: geological and geophysical studies of the zinc and lead mineralized belt in northwest Illinois and of the genesis of the ore.

Fluor spar studies: geology of the fluor spar districts of southern Illinois; study of the synthesis and properties of aromatic fluorine compounds and their possible industrial applications.

Silica and tripoli: fundamental physical properties of Ottawa silica and southern Illinois tripoli; viscosity of four-component silicate melts in certain composition ranges of the system lime-magnesia-alumina-silica to extend the information available in the field of rock wool, glass, and other products resulting from a similar technology.

Limestone and dolomite studies: distribution and occurrence of limestone suitable for the production of agricultural limestone; preparation of report on the soundness and weather resistance of the limestones and dolomites in the greater Chicago area.

Clays and shales: clay mineralogy of Illinois clays and shales; relation of the molecular structure of the various clay minerals to their base exchange characteristics and ceramic and other properties; studies in differential thermal analysis of clays; studies of the extractability of alumina, potash, and by-products from Illinois shales; clay mineral characteristics of soil-foundation materials in relation to their soil mechanics properties.

Ground-water geology: ground-water geology of industrialized and urban areas; geophysical studies of important water wells requiring rehabilitation; earth-resistivity surveys to aid in locating water-bearing gravels in glacial deposits for municipalities and industries.

Engineering geology: study of geological problems of

highway construction and maintenance, dam and reservoir sites, heavy building construction, etc.

Topographic mapping: enlarged program of topographic mapping in cooperation with the U. S. Geological Survey, with a view to completing the mapping of the state in eight years.

During the war the Survey emphasized primarily those research projects of special importance to the war effort, including three important laboratory research contracts for federal war agencies and certain projects in cooperation with the U. S. Geological Survey and the U. S. Bureau of Mines. The new laboratories of the State Geological Survey had been completed only 10 months prior to the attack on Pearl Harbor, and the value of the results fully demonstrated the wisdom of possessing adequate facilities and research staff qualified in various fields.

Its scientific and technical staff comprises 32 geologists, 15 chemists and chemical engineers, 2 physicists, 1 petroleum engineer, 1 mining engineer, 1 mechanical engineer, 1 mineral economist, and 18 research and technical assistants. Of those above the grade of research assistant 41 per cent have Ph.D. degrees, 38 per cent have M.A. degrees, and the remainder have B.A. degrees with advanced training and experience. The research assistants have B.A. degrees. This group is supported by a full-time librarian, an editorial staff of 5 people including draftsmen, a photographer, an instrument designer, a garage superintendent and assistant, and a secretarial and clerical force of 18 persons. Some college professors participate in research as their time permits, and a considerable number of college students assist during the academic year on a part-time basis and during the summer on full time.

The Survey's quarters are in the new Natural Resources Building, constructed in 1939-40 at a cost of approximately \$750,000, including cost of equipment, to house the Geological Survey and the Natural History Survey. The portion occupied by the Geological Survey contains 28 offices and 24 laboratories, a library, technical files, drafting rooms, grinding rooms, mailing room, and storage rooms for systematic filing. An applied research laboratory, built in 1940 near the University's new power plant at a cost of about \$175,000, including equipment, provides facilities for large-scale research in coking, briquetting, and improved preparation and combustion tests of the state's large resources of coal. A 44-car garage, constructed in 1942 for the use of both Surveys, also contains a special machine shop for the construction of research equipment which cannot be purchased on the open market.

In making these provisions for extensive and detailed research of its mineral resources, authorities and leading citizens of the state recognize the rank

of Illinois in its regional economic province—the Upper Mississippi Valley—and in the nation, and also the technologic requirements of the new era upon which we have entered. Even in the darkening days of the depression in 1931 the state aided the Survey with increased appropriations to set up chemical and physical laboratories of research in temporary quarters and to extend its field inquiries in both geology and geophysics.

The last session of the General Assembly appropriated \$1,946,000 for three wing additions to the Natural Resources Building, affecting both the Geological Survey and Natural History Survey, and an additional \$165,000 for two additions to the Geological Survey's applied research laboratory to provide for large-scale investigations of the industrial min-

erals of the state, for experiments in petroleum recovery methods, and for preparation rooms and storage.

The Geological Survey and its two sister divisions, the Natural History Survey and the Water Survey, are divisions of the State Department of Registration and Education, and their policies, programs, and appointments are under the control of the Board of Natural Resources and Conservation. This Board is composed of the director of the Department, who is chairman, ex officio; the president of the University of Illinois, member ex officio; and specialists in the fields of geology, chemistry, engineering, biology, and forestry, most of whom are senior members of the faculties of the University of Chicago and the University of Illinois.—*M. M. Leighton*, Chief.

Letters to the Editor

Inactive by Internal Compensation

Prof. Noller's quandary (*Science*, 1945, 102, 508) concerning the rotatory compensation in meso compounds has, I suppose, perplexed teachers of stereochemistry as well as their students ever since the simplification was introduced that mirror images constituted the forms of enantiomeric pairs. This trick, of course, like the hydraulic analogy applied to electrical phenomena, has its limitations, which one is likely to forget during repeated usage.

The lecturer often uses his hands to illustrate non-superposability as well as mirror imagery but may forget to remind the student that not only are symmetrical objects both superposable and mirror images as well, but also that the test can apply only to configurations fixed with respect to some reference point. Thus, a shadowgraph of one's "asymmetric" hands, like stereographic projection formulas, does not illustrate configurational opposites unless it is understood that a reference point (*i.e.* the backs of the hands) is conventionally arranged.

In view of the student's ultimate introduction to modern concepts of optical rotatory power, this writer proposes that the qualitative concepts of these theories might profitably be introduced at the beginning of stereochemical instruction. Thus, by reference to Fig. 1, it can be shown that the arbitrary alphabetical order, *b c d*, indicates for the upper tetrahedron a counterclockwise sequence with respect to the fourth substituent, *a*. The lower tetrahedron exerts an opposite effect on the light beam owing to a clockwise sequence, *b c d*, with respect to *a*. Since these refractions are equal and opposite, it can in truth be said that meso compounds are optically inactive owing to internal compensation.

By contrast, the enantiomeric form shown in Fig. 2

can be analyzed from any arbitrary tetrahedral face, say *a c d*, with respect to the fourth substituent, *b*, as counterclockwise for both the upper and lower tetrahedrons. The refractions thus are in the same direction and support one another, to result in an optically active form.

Furthermore, if one substituent is hydrogen, the con-

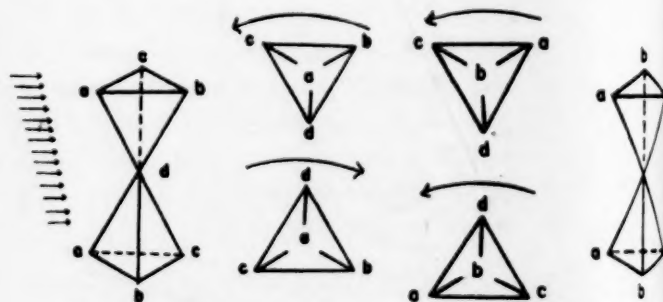


FIG. 1. Meso-form.

FIG. 2. d,l-form.

figuration can be assigned relative to glyceraldehyde, or to lactic acid by reference to such lists as that devised by R. E. Marker (*J. Amer. chem. Soc.*, 1936, 58, 975) thus to prepare the student for quantitative evaluations such as those of Born and of Kuhn, or the semiquantitative absolute configurational assignment of Boys (see Gilman's *Organic chemistry*, p. 1779).

Confusion for the student can indeed be avoided by advising him that enantiomerism is not a chemical phenomenon. This is further useful for his realization that enantiomerism is not bound by the fundamental concept of reversibility essentially inherent in every chemical change, and thus that a study of racemization can be superposed on any chemical process as an absolute and independent evaluation of that process.

If enantiomerism is thus defined and divorced from

configurational chemical isomerism, then the hitherto unknown isomers, which Prof. Noller points out may be expected if α,β -dibromo-, α,β -diiodosuccinic acid is synthesized, should be recognized as chemical individuals in their own right, since their molecular volumes, dipole moments, and reactivities of functional substituents will be different.

There will indeed be two possible meso-forms, but both of them will be optically inactive. Likewise, three chemically different isomers, because of restricted rotations, may be predicted for the d,l modification, but the optical rotation will be identical for all three.

When such isomers are isolated, it will be wise for stereochemists, in order to avoid confusion, to designate them by some other nomenclature than the already-specific terms "geometric isomer" or "diastereoisomer." Perhaps the term "restriction isomer" would be applicable.

GEORGE F. WRIGHT

Chemical Laboratory, University of Toronto

Relation Between the Diamagnetic Susceptibilities of Ions in Solution and in the Crystalline State

The diamagnetic susceptibilities of ions both in solution, X_s , and in crystalline state, X_c , were determined by G. W. Brindley and F. E. Hoare (*Trans. Faraday Soc.*, 1937,

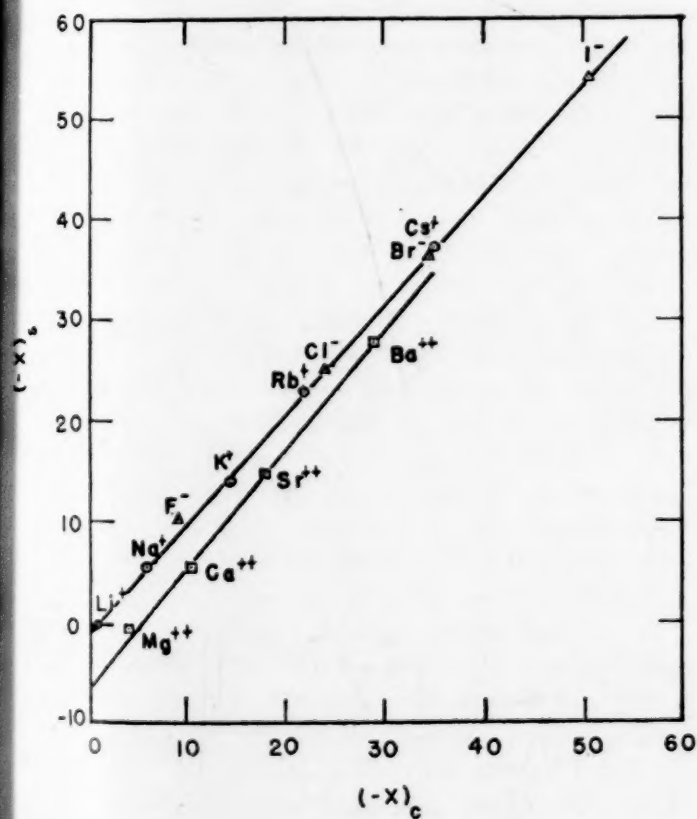


FIG. 1

33, 268). Their data were considered as very reliable by V. C. G. Trew (*Trans. Faraday Soc.*, 1941, 37, 476). Recently I have found a simple relation existing between the values of X_s and X_c which can be expressed as follows:

$$(-X)_s = a_1(-X)_c - b_1$$

where $a_1 = 1.09$ and $b_1 = 1.0$ for alkali and halide ions and 1.15 and 5.8, respectively, for alkaline earth ions with the exception of beryllium. The ionic susceptibilities are expressed in 10^6 c.g.s. units/gram-ion. The average deviation of calculated X_s from observed X_s is ± 0.3 for univalent ions and ± 0.4 for divalent ions. The relation is shown in Fig. 1.

The equation of ionic susceptibility is found to be similar to an equation of ionic volume (*J. Chin. chem. Soc.*, 1942, 9, 46): $V_s = a_2 V_c - b_2$, where V_s is the apparent volume of an ion in an infinitely dilute solution and V_c is the crystalline state as calculated from Pauling's ionic radius. Interpretation of the first equation with its bearings upon the nature of ionic solution will appear in the *Journal of the Chinese Chemical Society* (Vol. 12, No. 2).

F. H. LEE

Department of Chemistry, University of Nanking
Chengtu, China

A Comment on Discoveries in the Vitamin A Field

Some time ago (*Science*, 1945, 101, 183) I published a note on the use of Super-Filtrol as a new reagent for Vitamin A. Subsequently I was taken to task by several workers who pointed out that the blue color formed by Vitamin A on acid earths of various types had been previously discovered. This has now assumed the character of a race to see who can find the earliest discoverer of the phenomenon. Currently in first place is E. Lester Smith (*Science*, 1946, 103, 281), who dates the discovery in 1923 by Takahashi and Kawakami. Other contenders over the past year have been Meunier, Emmerie and Engle, and Kobayashi and Yamamoto (see *Science*, 1946, 103, 175, for references).

As the unintentional starter in this race, I cannot help but find it amusing that three out of the four authors who have championed prior investigators were just as ignorant of the work to which Dr. Smith refers as was I, the one toward whom their comments were directed.

I had not intended to rise in rebuttal in this matter, but noting that Dr. Hickman has replied to Dr. Smith's comment on his work, I feel encouraged to speak myself. Permission to publish the work I reported had been withheld until two years after the work had been done. By that time, I was working elsewhere, and in another field, and had no time to go into an extensive literature search. I did not feel that any harm or discourtesy would be done to possible prior workers inasmuch as I made no claims for discovering the general phenomenon. My paper was entitled "A new reagent for vitamin A" and was merely intended to report that I had adapted a specific acid earth to a field assay for the vitamin. I felt this to be a useful contribution which might prove of value to others in the field. I have been pleased to have this verified by the rather surprising number of requests for reprints which I have received.

ARNOLD LOWMAN

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Book Reviews

Hematology: for students and practitioners. Willis M. Fowler. New York-London: Paul B. Hoeber, 1945. Pp. viii + 499. (Illustrated.) \$8.00.

In this carefully written handbook of present-day information in the field of clinical hematology the author presents a discussion of the various hematologic disorders and offers very sound advice for their treatment.

The discussion of the leukemias is outstanding for its soundness. The chapter on iron-deficiency anemias is classical, and the whole subject matter of the anemias is more than adequately handled. The paragraphs on the significance of the various types of leucocytes are especially fine, as is the chapter on agranulocytosis and infectious mononucleosis. The chapter on transfusions is a much needed innovation in a student textbook of hematology. The index on the blood picture in infections is, however, too limited to be of much use.

Dr. Fowler has the ability to clarify the most pertinent information concerning the diseases he discusses. Although more attention could have been given the subject of the biologic significance of the hematopoietic system in relation to internal and external environmental factors of equilibrium, this book in general meets the needs of both students and practitioners.

S. P. LUCIA

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Manual of electroencephalography for technicians. Robert S. Ogilvie. Cambridge, Mass.: Addison-Wesley Press, 1945. Pp. xii + 100. (Illustrated.)

The book begins by discussing methods of setting up an electroencephalographic laboratory. It describes construction of a shielded cage, arrangement of equipment to avoid electrical interference, and the preparation, repair, and placement of electrodes on the scalp. Numerous details of running EEG tests are elaborated along with suggestions for the successful handling of patients. Most valuable is the discussion and illustration of numerous forms of artifact to which the EEG is susceptible. To the mind of the reviewer the only addition might have been a word regarding the necessity of recording eye movement, along with EEG, if it is to be satisfactorily discounted as a source of slow waves in the records.

Interpretation is necessarily treated sketchily in 33 pages, 17 of which are devoted to illustrating EEG patterns. The neurology presented is rather elementary, but interpretation is not, of course, primarily the province of technicians. Illustrations are limited to "monopolar" (scalp to ear lobe) records. Cuts showing important differences between monopolar and bipolar (both electrodes on scalp) records under various conditions might have been of additional service. The use of the term "monopolar" is questionable but follows precedent. "Fundamentals of Electricity" are touched upon in 10 pages.

A section on cost analysis for the electroencephalo-

graphic laboratory gives consideration to numerous and candid details.

This little manual will be useful to beginners in electroencephalography.

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Psychology: the fundamentals of human adjustment. Norman L. Munn. Boston: Houghton Mifflin, 1945. Pp. xviii + 497. (Illustrated.) \$3.25.

The beginning course in psychology has the different but not incompatible tasks of providing many students with an orientation in the science most intimately related to their own lives and at the same time affording specialized stimulation to the few students for whom it will be an introduction to a professional career. Each textbook for the elementary course must be evaluated on the basis of how well it serves these two objectives. In the present instance Dr. Munn has been conscious of the double task and in this reviewer's opinion he has met both needs well.

Psychology is defined as "the science of experience and behavior," which are "adjustments of the organism to the stimuli which impinge upon it." The emphasis is upon the psychology of the human organism, although animal experimentation is liberally used for illustration. The major organizational divisions in sequence are: scope and methods, development, learning and thinking, motivation, feeling and emotion, knowing the world, and finally, individual differences. Each of these divisions is introduced by a brief statement of its significance to the whole. Within each part the several chapters discuss specific aspects in detail sufficient to give the beginning student an appreciation of his own behavior as well as of the methods used in its scientific study. Perhaps more space than is necessary is spent on the anatomy and physiology of the nervous system, but such a judgment would probably not be concurred in by most psychologists. Far more important is the fact that the author has used the experimental literature aptly, and he documents his text well, but unobtrusively, so that the especially interested student may follow his own interest into more technical avenues.

In addition to the documentary references following each chapter there is also a list of further readings. This is only one way in which the author and publisher have sought to facilitate the student's use of this text. There are 226 illustrations, each of which serves a particular purpose, and many have extensive explanatory legends. The text is printed in two columns on a large page, which allows for easy reading and for more material within the total number of pages. In its organization, content and typography this is an excellent elementary textbook which should find wide usefulness in the current oversaturated college classes.

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